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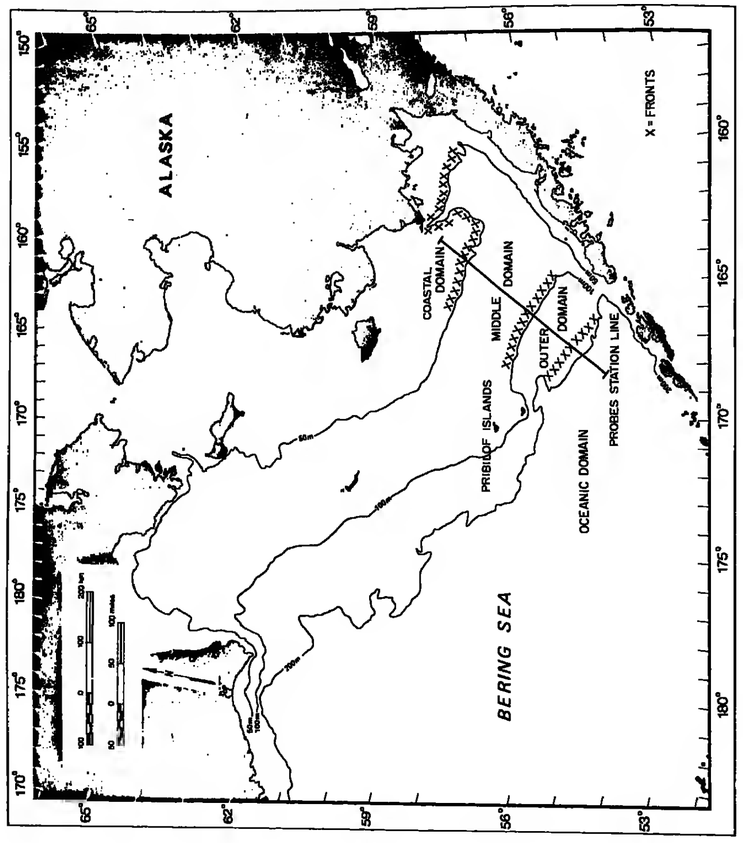

The Oceanography Report—pages 730–732

EOS, TRANSACTIONS, AMERICAN GEOPHYSICAL UNION VOL. 62, NO. 44, PAGES 729-736 NOVEMBER 3, 1981

Particles and Fields—Ionosphere

5935 Interactions between waves and particles
A UHF CROSS-MODULATION D-REGION HEATING EXPERIMENT at the ARECIBO OBSERVATORY
M.P. Sulzer (National Astronomy and Ionosphere Center, Arecibo Observatory, Box 995, Arecibo, Puerto Rico 00613) J.D. Mathews and A. A. Tauvo

A unique wave interaction experiment employing the Arecibo 2.0 megawatt 430 MHz radar as disturbing or heating transmitter has been performed. The purpose of this experiment was to evaluate UHF electron heating effects and to extend the wave interaction technique to higher than usual altitudes (100 km). The latter involved ext ruch smaller in amplitude extent than the heating or wanted beam yielding an unfavorable geometric weighting factor and making the experiment very sensitive to reflection properties of the E region. Nonetheless wave interaction was easily detected using a conventional digital signal processing technique. Comparison of experimental wave interaction results with a numerical model of the plasma indicates that lower thermosphere electron cooling rates are possibly too small by a factor of four. Power spectra of the 3.155 MHz wanted signal (reflected from E region) amplitude fluctuations for "solar" and "disturbed" days are also given. (UHF wave interaction, electron cooling, electron cooling)
(11,355, Paper 1L1754

5340 Particle precipitation
THE SIGNIFICANCE OF VLF TRANSMITTERS IN THE PRECIPITATION OF INNER BELT ELECTRONS
W. L. Imhof (Space Sciences Laboratory, Lockheed Palo Alto Research Laboratory, 3251 Hanover Street, Building 201, Palo Alto, California 94304), E. E. Anderson (Department of Physics and Astronomy, University of Iowa, Iowa City, Iowa 52242), J. B. Reagan and H. D. Evans (Lockheed Palo Alto Research Laboratory, Palo Alto, California 94304)

From the low altitude satellite P78-1, narrow and somewhat multiple peaks have been observed in the energy spectra at slantwise 44 to 1180 keV precipitating to the drift loss cone from the inner radiation belt. Simultaneously measurement of the plasma wave environment at higher altitudes on the same flight lines have been made with the ISEE plasma wave experiment in many cases. The peaks in electron energy are sometimes extremely narrow, being of the order of 10 keV wide since the instrument resolution is unlimited. The plasma wave observations in these cases reveal the frequent presence of single and sometimes multiple monochromatic frequencies in the 10 kHz to 25 kHz range which are attributed to ground-based VLF transmitters. The plasma wave experiment also provides electron plasma density profiles. The variations of the peak energies with L value and the nearly simultaneous and spatially coordinated narrow-band wave frequencies strongly support the conclusion that the narrow peaks in the electron spectra result from cyclotron resonance interactions with the waves produced by ground-based VLF transmitters and that the effects of two or more transmitters are sometimes observed simultaneously.
1. Geophys. Res., Blue, Paper 2A1401

5363 Plasma motion, convection, or circulation
TITAN'S ION EXOSPHERE OBSERVED FROM VOYAGER 1
S. M. Krimigis (JHAU/Goddard Space Flight Center, Laboratory for Planetary Atmospheres, Greenbelt, MD 20771), S. C. Mitchell, Jr., T. P. Armstrong, L. J. Lanzerotti, and S. M. Krimigis

Electron and ion measurements made by the Voyager 1 plasma science instrument revealed a plasma wake surrounding Titan in Saturn's rotating magnetosphere. This wake is characterized by a plasma that is more dense and cooler than the surrounding subsonic magnetospheric plasma. The density enhancement is produced by the deflection of magnetospheric plasma around Titan and the addition of exospheric ions picked up by the rotating magnetosphere. By using simple models for ion pickup in the ion exosphere outside Titan's magnetic tail and ion flow within the boundary of the tail, the intersection between Saturn's rotating magnetosphere and Titan is shown to resemble the intersection between the solar wind and Venus. Outside the magnetic tail of Titan, pickup of H^+ formed by ionization of the N exosphere is indicated when synthetic and observed ion spectra are matched. Close to the boundary of the tail, a reduction in plasma flow speed is found, providing evidence for mass loading by the addition of N_2^+/N_2CH^+ and H^+ to the flowing plasma. The boundary of the tail is indicated by a sharp reduction in the 10s at high energy electrons, which are removed by inelastic scattering with the atmosphere and centrifugal drift produced when the electrons cross the magnetic field draped around Titan. Within the tail the plasma is structured as the result of spatial and/or temporal variations. The ion mass cannot be determined uniquely in the tail; however, mass measurement suggests the presence of a heavy ion with a mass of order 28 amu (possibilities is N_2CH^+), suggested as the dominant ionsite ion of the ionosphere, which may flow into the ionosphere into the tail. (Ion exosphere, ion pickup, plasma measurements).
J. Geophys. Res., Blue, Paper 1A1563

5563 Plasma motion, convection, or circulation
ION-NEUTRAL MOMENTUM COUPLING NEAR OTSCRETE HIGH-LATITUDE IONOSPHERIC FEATURES
J.-P. St-Maurice and R.W. Schunk (Center for Atmospheric and Space Sciences, Utah State University, Logan, Utah 84322)

We have developed a two-dimensional numerical model to study the momentum coupling between the ionosphere and neutral atmosphere in the vicinity of discrete high-latitude features, such as convection channels and plasma density troughs. The model, which is based on generalized magnetohydrodynamic equations, takes account of global pressure gradients, viscous dissipation, ion drag, the Coriolis force, and electrodynamic drifts. From our initial steady state investigation, we have found the following: (1) in convection channels, significant shears and rotations of the thermospheric flow can occur below 200 km if a minimum in the electron density profile is present between the E and F regions. (2) In convection channels, the thermospheric wind decreases with height in the E-region owing to the effects of horizontal viscosity; (3) At ion altitudes, the boundaries of convection channels may produce frozen-in spirals; (4) A convection channel acts to induce a thermospheric motion over a region that extends up to 1000 km on both sides of the convection channel owing to the effects of horizontal viscosity; (5) in general, thermospheric winds driven by large-scale pressure gradients have an appreciable effect on the thermospheric flow in and near convection channels; (6) narrow channels of rapidly convecting, ion density plasma produce a small thermospheric response; and (7) ion-drag heating is generally the dominant heat source inside convection channels, while viscous heating can be the dominant heat source both inside and outside of convection channels.
J. Geophys. Res., Blue, Paper 1A1358

5380 Wave propagation
DESCRIPTION OF VHF GEOSTATIONARY SATELLITE SIGNALS NEAR THE EQUATORIAL ANOMALY CREST
H.C. Lee (Regis College Research Center, Weston, Massachusetts 02193), A. DasGupta, J.A. Klobuchar, S. Basu and S. Basu

The nighttime polarization fluctuations of linearly polarized 136 MHz satellite signals received at Ascension Island located near the southern crest of the equatorial anomaly have been shown to be the manifestation of depolarization effects due to the diffractive scattering by small-scale (<200 m) density irregularities with power-law spectra. The theory can explain its coexistence with L-band scintillation. The absence of this phenomenon at equatorial locations off the anomaly crests is attributed to two factors: (1) the ambient plasma densities are relatively low and (2) the propagation angles to the satellite signals are most nearly perpendicular to the geomagnetic field. Depolarization, equatorial anomaly, irregularities, L-band scintillations).
Rad. Sci., Paper 1S1A1b

1181 X rays, gamma rays, and neutron rays
MRAD 3 MEASUREMENTS OF THE ATMOSPHERIC POSITRON ANNIHILATION LINE
W. A. Mahoney (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109, U.O.A.) J. C. Ling and A. S. Jacobson

All instruments with the High Energy Resolution Gamma-Ray Spectroscopy Experiment (HRAD O-1) on the third High Energy Astronomy Observatory (HEAO 3) contain a strong line at 511 keV resulting from positron annihilation. This line originates in the instrument itself, the earth's atmosphere and cosmic sources, possibly including the diffuse cosmic background. In order to understand the emission from cosmic sources, the atmospheric positron annihilation line emission has been determined as a function of geomagnetic latitude and zenith angle. Although the intensity of the line increases with increasing latitude, it was found that variations with zenith angle can be satisfactorily explained if the atmospheric emission exhibits significant limb darkening. The atmospheric line has an energy of 511.07 ± 0.10 keV and a mean instrumental width corresponding to a full width at half maximum (FWHM) of 2.29 ± 0.20 keV FWHM. Characteristics of the instrument background have allowed an upper limit of 9.4×10^{-4} photons/cm²-sec-sr to be placed on any source (≥ 3 keV) diffuse cosmic emission at 511 keV.
J. Geophys. Res., Blue, Paper 1A139b

1599 General or miscellaneous
NUMERICAL SIMULATIONS OF A RADIALLY INJECTED BARIUM CLOUD
Daniel J. Swift (Geophysical Institute, University of Alaska, Fairbanks, Alaska 99701) Eugene M. Wescott

Electrostatic two-dimensional numerical simulations of a radially symmetric barium injection experiment show that ions created by polar UV irradiation are incorrectly loaded onto the magnetic field lines to which they are created. Two possible instabilities are identified but neither of them produces the barium plasma cloud to polarize in a way that would allow the plasma to drift up with the neutrals. In a second model the velocity of the neutrals was allowed to be an azimuthal function of velocity. In this case a portion of the cloud did polarize in a way that allowed a portion of the plasma to detach and move outward at the approximate speed of the neutrals. No rapid detachment was found near only the density of the neutrals was given as azimuthal symmetry.
J. Geophys. Res., Blue, Paper 1A1412

Editorial

Instrumentation Crisis for VGP

The status of geochemical/mineralogical instrumentation is a matter of great concern. Not only is much of the present equipment obsolete and poorly maintained because of lack of technical staff and money, there is also great concern about the pressing demands of new instruments (e.g., synchrotrons, ion microprobes, high-energy mass spectrometers). Problems concerning instrumentation pervade the entire field of science, and they are particularly severe because of the cuts in the overall government budgets. These problems are recognized by the National Research Council (NRC) and the General Accounting Office and are the subject of several studies. The pressures on the Earth Sciences Division of the National Science Foundation have been pointed out by its director, Robin Brett, and there is extreme concern at the moment about the science budgets as opposed to the engineering budgets of NASA.

To study the status of geochemical/mineralogical instrumentation, an ad hoc committee of the Geological Sciences Board (GSB) of the NRC has been appointed by GSB chairman, William R. Dickinson. The members of this committee are cochairmen William W. Hay and William C. Luth; Gerald V. Gibbs, Joseph V. Smith, George R. Tilton, and W. Gary Ernst. Dickinson proposed the following questions:

1. What, in fact, is the state of instrumentation nationally, i.s., is total inventory adequate and is it being used effectively?
2. What can be done within the framework of foreseeable federal budgetary constraints to alleviate shortages that exist?
3. What is industry's potential role in addressing the overall funding problem?
4. Are there new creative or alternative methods for financing (i.e., in acquisition, maintenance, upgrading, replacements, etc.) that might exploit available resources more satisfactorily?
5. Is there a conceivable role for identified regional research centers or shared arrangements that offer advantages so far unexplored?

Other questions will be addressed when they have been properly identified.

The first meeting of the ad hoc committee was held at Cincinnati during the GSA Meeting. The second meeting will be held in San Francisco during the AGU Meeting, and an open informal session will also be held during the AGU meeting. The report of the ad hoc committee must be completed by March 1982.

My own views, which are tentative, can be discussed under two major headings.

The Need for More Funding

Geochemical instrumentation is severely underfunded in relation to some other areas of scientific instrumentation. This is partly the result of the relatively simple instruments used in geochemistry up until the last 20 years. Whereas nuclear and particle physicists were already using expensive generators some 40 years ago and had developed large teams of engineers and scientists over the following 20 years, most geochemists, even today, work in small independent laboratories that are poorly equipped with technical staff and facilities. Only some are fortunate enough to work in institutions with access to first-class technical services. The problems become increasingly severe as certain instruments (X ray diffractometers and electron microprobes and microscopes, for example) become absolutely fundamental to both research and teaching programs, while other instruments are being developed (e.g., pulsed neutron generators, X ray and ultraviolet light sources, high-energy mass spectrometers). If overall funding is to stay level, or even to decline, I can see no way that all desirable goals can be achieved. Hence our long-term primary goal is to find out whether the total funding can be increased in the face of intense competition. Ultimately, this becomes a political and sociological question from which a wide range of views can be expected. No doubt some of you will speculate on the relative cost of scientific research and other human endeavors; in particular, expenditures on war and defense and on various drugs might be discussed.

In the short-term (approximately 5 years), it seems likely that federal and state funds will prove to be strictly limited. In theory, tax reductions for both individuals and corporations should lead to a greater amount of disposable income. In practice, gifts of either money or equipment will probably prove to be erratic unless a national sense of urgency translates into a major campaign of systematic donations. The Petroleum Research Fund of the American Chemical Society has been very efficient in dispensing research grants from industrial funds. Should an industry-wide effort to disburse funds for research facilities and instruments be organized in geochemistry? It seems totally impractical to organize gifts from individuals, and efforts by individual institutions should prove more profitable. But to be successful, there must be a recognition by wealthy potential donors that scientific research, in general, and geochemistry, in particular, needs a lot of help. Is it realistic to expect an individual to donate a half million dollars for a new electron microprobe at his or her alma mater, especially when university administrators are trying to raise money for faculty salaries and buildings?

The Need for Improved Efficiency

Whatever the chances of increased funding, it is imperative to find ways of using present equipment with greater efficiency. Probably some distinction must be made between 'frontier instruments' and 'basic instruments.'

About the only way to save substantial amounts of money on new expensive instruments that open up new frontiers is to limit the number. This automatically leads to establishment of 'research centers.' I maintain that it is false economy to starve such a research center. Each one should be enabled to compete on a worldwide level; in particular, it should be staffed by first-rate people paid on, at least, a semipermanent basis instead of on the more common catch-as-catch-can basis. It may be possible to save some money by joint development of instruments with technologists in other countries. This has the additional psychological benefit of forging international friendships in this era of dangerous nationalistic feuds. However, it is a nuisance, at best, and a downright pain, at worst, for an outsider to work at a research center, even if the staff goes out of its way to welcome and help visitors. To minimize these problems, locations should be chosen to ease travel. Commuting by car, bus, or train is cheaper and generally easier than overnight stays after long flights; furthermore there is less dislocation of teaching and family life. There are many grave disadvantages to 'research centers,' and I am sure that there will be considerable trailing against them. Hence, it is important to minimize the need.

Turning to 'basic instruments,' there is much that can be done. First, it is necessary to encourage manufacturers to avoid unnecessary 'bells and whistles.' After some years of development, there is a danger that a basic instrument becomes loaded with unnecessary frills. I believe that new electron microprobes are becoming too complex and too expensive. Who needs a servo-operated sample chamber powered by air compressors? Who needs an SEM facility on an electron microprobe used mainly for analyses on grains at least 10 μm across? Let us urge construction of basic instruments whenever possible. Two instruments at $250,000 can be better used than one at $500,000. Second, existing instruments must be kept in service for a longer period. Of course, it is nice to boast about the latest shiny paint, but perhaps we should boast instead about the Puritan virtue of make-do-and-mend. Preventive maintenance and judicious rebuilding can work wonders on some old instruments, but only if excellent technical staff are in charge. In general, service from manufacturers is expensive and not always efficient. I believe that a university can make a profit by paying for a highly skilled cadre of technicians who can handle essentially all instruments. Third, some instruments built before the computer era can be upgraded successfully by addition of a computer and an interface. For example, a Picker, four-circle X ray diffractometer could be purchased last year for $12,500 and automated for $30,000 to produce an instrument superior in some respects to new ones costing over $100,000. There are thousands of X ray powder diffractometers that can be automated by addition of a stepping motor, an interface, and a computer for between $15,000 and $30,000; compare this with the $80,000–$100,000 for a new instrument. It is important to install some new instruments on a regular and continuing basis, but revamped older instruments can serve an important function, especially for teaching. I recommend that funds be made available for renovation and automation of as much existing equipment as possible. A careful choice must be made of the type of equipment. Thus, some electron microprobes have such poor optical and vacuum systems that automation is not worth the cost. Again, I emphasize the importance of first-rate technical staff and facilities, especially in teaching institutions, which are responsible for training a new generation of scientists. Fourth, I recommend that universities teach more courses on laboratory principles and practice. These might be staffed in part by the technicians mentioned above. Scientific societies should consider giving short courses on new techniques and should arrange for dissemination of appropriate information on upgrading old basic instruments.

Other questions that should be addressed include

1. What should be the distribution of research funds (e.g., from NSF) between equipment costs and other categories, such as salaries?
2. Is there a current shortage of trained technical staff? What are future prospects for industrial recruiters?
3. Should there be coordination between government laboratories and private institutions, and to what degree?
4. Is it important to find ways for U.S. companies to recapture instrument sales in areas now lost or almost lost to foreign companies (e.g., in X ray diffraction instruments)?
5. Should a program be established to cover costs of transferring older instruments from industrial companies and government laboratories to teaching institutions both in the U.S. and abroad?
6. Do some users treat instruments as 'black boxes,' and if so, should training programs based on fundamental principles be established?

We anticipate a thorough review of the instruments in a representative set of laboratories, and an appropriate questionnaire is being prepared. However, this will need to be supplemented by as much 'anecdotal' information as possible.

Please send your ideas, preferably in concise writing, with formal permission to quote them in a final report. If you wish to phone me, please do so, if at all possible on a Wednesday, at (312) 753-8632, 8:30 A.M.–7:00 P.M. I prefer this day for administrative and miscellaneous matters and try to keep other days for teaching and research.

Joseph V. Smith
President-Elect
VGP Section

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Cover. A woodcut by Fridtjof Nansen, oceanographer and polar explorer and Nobel Peace Prize Winner (1922), depicting himself strolling on the ice with a triple curtain-like form of the aurora overhead (from Nansen's Nord i, Takeheimen, 1911). From the piece *Physics of Auroral Arc Formation, Geophys. Monogr. Ser.*, vol. 25, AGU, Washington, D.C. edited by S.-I. Akasofu and J. R. Kan. For details see p. 1155

News

Earth Dynamics Study

The 56 investigators in NASA's Crustal Dynamics Project met in September at the Goddard Space Flight Center to revisw the project, which will study the earth's tectonic plate movements, crustel deformation, and rotational dynsmics. European investigators convened October 30. Using precise geodetic date obteined with such space techniques ss leser renging end redio interferometry, investigetors will study regional crustel detormation in Celitornio, Aleska, and other regions ol high earthqueke activity; the current-dey relelive motion between the eerth's major tectonic plates; the internal stebility ot the North Americen and Pacific plates; end verietions in the Eorth's rotetion rate end position of its polar axis. The project will extend through 1988.

Two tschniques heve been developed to make precise measursments between two points separsted by larga distences (thousands of kilomsters). The first involves lesor renging to artificial setellites and to the moon. The LAGEOS aatellite, launched by NASA on Mey 4, 1976, into e nearly circular orbit at en altitude ot 5900 km, is a sphere whose surface is covered with 428 optical-cube corner reflectors which retlect any incident optical signal back to tho source. By eccurately end repentedly measuring the time for s leser pulse to travel to the setellite and return, the position ot the ground laser can be determined with high accurecy. When simtlar measuromenta are made from s second etation (which can bo located on a diffsront continent), the distance botween the two stations cnn be determined with a precision of nbout 5 cm. Lunar rollectors were implanted by tho crowe of Apollo 14, 15, and 16, and by two Sovlot unmanned Luno missions. In addition tn studiee of the eorth, lunor laser ranging hns provided valuoblo inlormation on tho dynamic motion of tho moon and its orbit and has been used to atudy theories of general relativity.

The second technique, called Very Long Beseline Interferometry (VLBI), involves the anelysis ol radio signals emitted by quesars and other celestial objecte. These emissions are received and recorded on magnetic tape by two or more redio telescopes separated by lerge distances. These signals are subsequently compered to determine the difference in the timo ot which the signals reached each telescopo, end the timo differences are analyzed to delormino the proclee distance botween each of the stations. Currently, the precision ol this lechniqua is on the order ol 3 cm. By making repeated measurements over s period of years, using both techniquee, crustel motions as smali as 1 cm per year can be delermined. Current knowledge of the relative molions of the tectonic plates is based on paleomegnetic data and other intormetion and is averaged over the past severel million years of geologic time. These averaged rates are estimated to be between 1 end 20 cm-yr. Using laser renging end VLBI, these movements can be directly measured for the first time, and tectonic models can be revised to reflect contemporery plete motion.

In California, Alaska, and other regions ol high earthquake activity, the driving lorces ol plete tectonics cause a buildup ot crustal atrein near plate boundaries. When the reeulting etress exceeds the strength of the underlying materials, the stresa is released in the lorm of earthquakes or slow creep. A major objective of the Crustal Dynamlce Project is to meaeure and analyze regional deformation and strein accumulation elong mejor plete boundaries euch as the San Andreas Fault in Celifornia, which separates the North American Plate lrom the Pacific Plete. This will help us to underetand the basic mechenisms leading to earthquakes end eventually to the development of e relleble earthquake prediction model.

In order to meaeure the accumulation of crustel strain over an active tectonic region, measurements must be mede at meny ereas. NASA hee developed highly mobile syatems, using both laser ranging end VLBI technology, which can easily relocate lrom one site to another within a metter ol days. Mobile syetems using VLBI techniquee have been developed at the Jet Propulsion Laboratory, and mobile lasor systems have been developed at Goddard Space Flight Center and the Univeraity of Texas.—*PMB* ⊠

Hot Plasma Zone Near Saturn

Invastigatore using data collected by Voyager 2 during its flyby ol Setum lhia paat August have found e place in the solar system containing the hottest gas yet observed. Temperatures in a region of spece eround Saturn ronga from 300 million to nearly 1 billion° C. The hot gas is an enormoue doughnut-shaped region encircling Saturn at en eltitudo renging from 273,600 km above the planet's cloud top to es high as 724,000 km.

The discovery wes announced el e colloquium at the Applied Physics Laboratory of The Johns Hopkins University, Baltimore, by S. M. Krimigis, chief eclentist of the Applied Physics Laboratory Space Department, who is principal investigotor ol the Voyeger Low-Energy Charged-Particle Experiment, which mede the obaervations. The measurements were analyzed by e leem thal includea investigatore from The Johns Hopkins Univerelty, the universitiee of Maryland end Kansas, Bell Telephone Laboratories, and the Max Planck Institute in Germany.

'The temperelurea,' Krimigis said, 'ere ebout 300 timae hotter than tha solar corone, and twice ee hot as the Jupiter pleame cloud discovered by our inatrument on Voyeger in 1979.'

'The reason that the spacecraft survived passage through this region,' explains Louis Lanzerotti ol Bell Laboretories, a coinvestigator of the experiment, 'is that the density of the gas fa very small, only about 30 particles in e cubic loot; so, there were not very meny lons hitting the spacecreft and heeting it up.'

Ths low-anergy charged-particle instrument is designed to messure lost (e few thousand milee per second) iona and electrons in ths magnetoapheres of the planets and in the interplenetery medium. Ths instrument can distinguish ssveral siemsnts, such as hydrogen, helium, oxygan, sulfur, sodium, and othsrs; meesure the direction in which theee high-spsed particles ere moving; and the temperature ot this particls population when the plesma is very hot (tens ol millions of degrese). Ths instrumsnt is also cspebls of identifying ths squivalent of the Van Allen belts and radiation zonss in ths magnetosphere of the planets.

The region ot spece around Satum occupied by the hot plasms torua aasms lo ba centered around the orbits of Dione and Rhea, two of Saturn's icy moons, and to extend lurthar away from ths planet on the dayside then on ths nightside, Krimigis said. He also noted that in this region ot space Pioneer II end Voyagsr I experimsnts hed shown the presence ot a relatively 'cold' plasme (tempsretures ot a lew million degrees), which waa a thousand times denssr than the hot pleeme identified by Voyeger 2. No obvious explenetion wes offered for the heeting mechanism ot this gas. [Source: NASA]—*PMB* ⊠

New Water Year Hae Wet Start

Streemflow during October, the first month of the 1982 water year, waa in the normal range over most of the country, but well-below normel streemflow still persists in the Soulheast, according to the U.S. Geological Survey.

The wetsr year used by hydrologists runs lrom October 1 ol sny calendar yeer to Septembsr 30 ot the following calendar yeer, and it is designed to roughly follow the growing season end lo begin end end during a period of generelly low streemllow.

USGS hydrologists seid that ebout 80% of the key Index atetione reporting across the country showed normal to ebove-normel streamflow during Octobar. By contrast, 6 months ego, more than hell of the key Index stetions reporting during Mey ahowed well-below normel streamflow—within the lowest 25% ol record, thet le, 75% of the time, flow will be aqualed or exceeded.

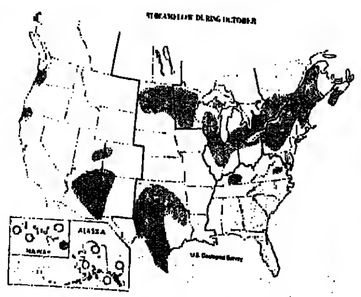
Although tha nation's water reaources picture is off to a generelly wst stert for the new water year, USGS hydrologiste said thot it will teke severel months of above-normel precipitetion to reverse the effects ot the previous dry months.

Streamflow throughoul much of the Southeest remeins well-below normel. Flows ol more then helf of the key Index streems lrom Virginia south to Florida and west to Alabama were et well-below normel levels for October. Streemflow on ell four ksy streems in Georgia wes below normal lor the fourth straight month.

In contrsst, above-normel streemflow predominated in e broad regional bend from New England through the Greet Lakes stetes and into Minneaota and North Dekota. Lergs sreaa of ebove-normel streemflow were also reported in Arizons and New Mexico end in Texas and Oklahoma, where eevere flooding boosted flows ot meny streams.

As an indicetion of the generelly healthy water situation in much of the United Stetes during October, combined llow ot the nation's 'Big Five' rivers (Mieeisaippi, St. Lawrence, Ohio, Columbia and Missouri) averaged 483 billion gallons a dey (bgd), ebout 2% ebove normel. The combined flow of theae rivers hes been in the ebove-normel range now for five streight months. The Big Five rivers account for streemflow runoff in ebout helf ot the contermInous United Stetes and provide a useful check on the etetus of the nation's weter resources.

Individuel flows ot the Big Five for October: Mississippi River neer Vicksburg, Miss., 178 bgd, 5% below normal and 21% below September; St. Lawrence River near Massena, N.Y., 193 bgd, 17% above normal and 1% above September; Columbia River at The Dalles, Ore., 55 bgd, 7% below normel and 8% below leat month; Ohio River at Louisville, Ky., 23 bgd, 2% below normal end 20% below September; Missouri River at Hermann, Mo., 34 bgd, 12% below normal and 5% below leat month. (Photo credit: U.S. Geological Survey, Department of the Interior.) ⊠



Above normal (within the highest 25 percent of record for this month).

In normal range

Below normal (within the lowest 25 percent of record for this month)

Conference Reviews R&D Budget

About 85 university officials, laboratory directors, industrial reaearch executives, scientiste, and enginesrs gathered in Washington, D.C., et the invitation of Nationel Academy of Sciences President Frenk Press, to discuee the outlook for and the implicatione of the federal reaearch and development budget for fiscal 1982 and beyond. The conseneus of the group is that President Reegan'a proposed 12% across-the-board cut, if effected, would ssvsrely damage science; that the White House should review reaearch funding to meks more productive use of reeearch dollars; that science end technology are vital to the Rsagan administration's goals; and that baaic research should take priority over development.

George A. Keyworth, director of the Offics of Science and Technology Policy (OSTP), and Fred Khadouri, associate director tor natural resources, energy, and sclance in ths Office of Manegement and Budget (OMB), also attended the meeting on October 26 and 27. They advlaed the group to be realistic and not assume the worst ceae. In addition they told the conference that during thie period of fiscal reetraint growth will be restricted; nevertheleas, science will be treated with senelitivity.

Fearing, however, that the reslricted growth esaociated with the budget elicing will irrevocebly herm science, the conference perticipants voiced their concerne to the Administration and Congress. Press emphasized thet the gathering was not e confrontation or a lobbying effort.

Reagan's proposed reductions 'will do irreversible damage unless longer-term research, in contreet to development and demonstration, is protected,' according to a statement leeued at the conference's conclusion. Aa exsmples, the essembled scientists pointed out that young investigatois, early in their careers, would not receive eupport lor their work. In eddition, science teems would be broken epert, and the poor opportunities perceived by young people would reduce the supply of scientists.

Thia manpower problem concems industry the most, according to Keith McHenry, vice presidsnt for research and development et the Amoco Oil Co. Henry Feshbach, physics department chairman at the Meeeachusetts Institute of Technology, noted thet in the physicel sciencss the manpower numbers will be back 'to the pre-Sputnik era' if the proposed cuts ere epproved. Press added that such e trend would not be eesily reversible because the cycle lor 'building end rebuilding' science approximatea 5 to 10 years.

The conference perticipants also agreed thal 'continued eound investments in reaearch and development by the federal government are essentiel to our netional goals.' Their stetement continued, 'Because of the important relationship between research, technology, and increased productivity, the expressed goels ot this Administration lor a strong economy and improved national securily demand more, rather than lese, investment in basic research.'

While recognizing the need for tightening the federal money bell, the perticipents urged the Administration and Congress to teke an ecross-government view of R&D end to meke budget adjuetmente while meinteining the basic sciencee. OM8 end OSTP were suggested as candidates for performing such a review. The group also asked thet the government recognize that 'education in the sciences is inexlricebly linked to research' and urged thet graduate student eupport be continued through research grants, fellowehips, and traineeships.

Substituting a large part of government support with industry support wae not an acceptsble solution to the problem. 'This growing relation between universities and industry is leudeble, and the nation can only benefit from these partnerships. Yet,' the scientists egreed, 'such a relation cannot become a eubstitute for the sirong government-university partnership in support of basic research which now exists.'—*BTR* ⊠

Memorial Fund for Henry Faul

The University of Pennsylvania hae eetablished a memorial lund to honor Henry Faul, professor ot geophysics. The fund will be used 'to remind future generetions ot Penn geology students of the effective end uniquely personal leadership role Henry played' in the geology depertment during the last 18 yeare, according to Robert Giegengack, department chairman. Faul died on September 16.

Contributiona may be made to the truetees of the University of Penneylvania for the Henry Faul Memorial Fund, c/o the Department of Geology, University of Pennsylvania, Philadelphia, PA 19104. ⊠

Geophysicists

Gordon J. Bell, 57, died on Mey 8, 1981. A member of the Meteorology Section, he joined AGU in 1974.

John D. Hale, 88, died on April 17. A member of the Tectonophysics sections, he joined AGU in 1946.

Lloyd Herrold, 73, died on September 16, 1981. A Life Member, he joined AGU in 1935. He was e member of the Hydrology Section.

Henry Hample, 89, died on October 13, 1981. A Life Member, he joined AGU in 1933. He was e member of the Geodesy Section.

Jorgen Holmboe, 78, died recently. A Life Fellow, he joined AGU in 1936. He wae a member of the Meteorology section.

Stephen W. Nile, 77, died on February 22. A member of the Selemology section, he joined AGU in 1947.

Garril H. Taebes, 54, died recently. A member of the Hydrology Section, he joined AGU in 1966.

New Publications

Modern X-Ray Analysis on Single Crystals

Peter Lugsr, Weller de Gruyter, New York, 312 pp., 1980, $48.00 (cloihbound).

Reviewsd by Paul B. Moore

One mey esk 'Why a new book on crystal structure enalysis?', and juelifiebly so. I was brought up on thet great classic *X-ray Crystallography* by Martin Buergsr, written some 40 years ago. It was, and still is, a gold mine of information, meny tedious calculetione of which Buerger did himself. But crystellography as science has its own autoimmune system. The science hes bscome so fundamental and eutomated in repid information retrievel that it is now a servant to other sciences. Crystel structurss are aolved no longer for their own sake but for the increase ot knowledge of the chemicel bond in whatever field it mey be.

Thia pretty little book with its cartoons of bsby's head and symmetry operations around it is ideal for the modern student who will probebly use crystallography as e tool. Consider ihe chapters: metrices, vectors, diffrecilon theory (52 pp.), film meihods, X-reys, choice of apperatus (59 pp.), cryetal symmetry end space groups (85 pp.), dittractomsters (29 pp.), phaee problem (62 pp.), and refinement (38 pp.). Eech is a good, thorough distillate ot earlier works. Flow diegrams of symmetry operations appear, often s one-pege encapsuleiton of whet would tormerly constitute a whole treatise. Most important for this book is e considerable discussion on computer-assisted structure analysis: direct methods end refinements. Smell (but to the scientist, often crucially importent!) detelle are not left out, for example esaeseing cryeial quelity.

In cryatal structure anelysis, es in other sciences, 'the mills of the gods grind slowly,' so es years pase, new and clever shortcute are discovered. There is no competition: the world has two placee. There are pieces for Buerger's classic work and for Lugar's compact little book, which, by the wey, generously refere to the varied classics in the field. This would be an excellent book lor e greduete course in chemistry, geochemistry, etc., on e powertul and vital kol.

Paul B. Moore is a professor in the Department of the Geophysical Sciences at The University of Chicago.

AGU Geophysical Monograph, vol. 25, Physics of Auroral Arc Formation, *is based on the proceedings of the Chapman Conference on the Formation of Auroral Arcs. The conference was financially supported by the National Science Foundation, NASA, the Air Force Geophysical Laboratory, and the Lockheed Research Laboratory. The following essey, written by the conference covener, surveys the subject of the conference.*

Physics of Auroral Arc Formation

S.-I. Akasofu end J. R. Ken (Eds.), *Geophys. Monogr. Ser.*, vol. 25, AGU, Washington, D.C., xii + 465, 1981, $25.00.

The aurora hee been one of the most challenging problems in geophysics, but it hes finelly begun to yield its secret. The polar aurore eppears in s narrow belt called the 'auroral ovel,' which surrounds the geomagnetic pole. A woodcut of the aurore by the great polar explorer Fridtjot Nensen (see this week's cover of *Eos*), illustretes, fairly accurately, the thin curtain-like torm of the aurore, extending from the zenith to the horizon. When thie curtein-like torm is observed from a distant point outside (south of) the ovsl, it appeare as an arch-like luminosity above the northern horizon. It was this particular torm that was officially classified as an 'erc' by Carl Störmer, who produced the first catalog of the auroral forms. Thie le the origin of the term arc, although we now use it to describe the curtain-like discrete form.

There is little doubt that the aurora results from an electrical discherge process powered by the eoler wind-magnetosphere dynemo. It has elso been found thet there existe e potentiel drop of ths order of a tew kilovolts along euroral field linse, which is largely responsible for ths acceleration ot auroral particles. Until asverel yssre ego, it hsd bean thought thet a tield-aligned potsntial drop was sxtremely unlikely to occur in e collisionless magnetospheric plesma. In tact, this wss avsn a 'forbidden' thought for many ysare.

Thess remarkeble advsnces in auroral physics during tha last severel years are a rsault ot sxtensivs obasrvations of auroral particlaa, tield-aligned currsnts, and slectric tields, as well as thsoretical studiss of ths relationahip among theas obsarvations. In July 1980, an AGU Chapman Conference was hsld at ths University of Aleske to discuss the aubject of ths eccelereiion procaas of the eurorel particles.

Two important gosls were sst for ths confersnce: (1) identification of possibls plasma processsa that can bs responsible for ths csuse of the potentisl structure, and (2) sxchenge of idsas, among theorists end experimentera, on relevant plaame proceeaas.

During the laat dscede, sevsral intsresting obsarvetions and thsoretical studias have contributsd to rsvsaling the geometry of the eurorel potential atructure. Avellable obaervetione euggest that equipotential contoure in a meridien plane croes aection of the structure ere V shaped or S shepad or a combinetion of the two. For the V shaped geometry, electrons will be eccelerated more elong the center lina than elong tia northern and southern skirts. It appaars thet the V sheped potentisl structura hes at least two scale aizes: The litat hae e latitudinel scale of a tew hundred kilometers, and the second hes a latitudinal scalo of a tow kilometers or lees embadded in the larger-scala ona.

There wes little doubt emong the conferance participants lhet the electric curranta elong geomegnetic field lines (tield-aligned currents) ere closely associated with the tormation ot potentiel structure. It is fikaly thot there is a limit to ths current denaity (~10^{-6} amp/m^2) of upward (tield-aligned) currents carried by magnaiospheric alectrons owing to the mirroring ot these alectrons as they descend toward the poler lonosphare. However, whan tha solar wind-magnetoephere dynemo imposaa more than ths limiting current density, the magnaiosphare-lonosphera system dovelops a potential drop to allow tha alectrons to carry more currant to tha lonoaphere.

In the pest we heve identified double layars, alectrostatic shocks, differentiel pitch-angle anisotropy, anomalous rasistivity, and others es posalble mechanisms for supporting the potential drop along tield lines. The importance of a double layer in accelerating auroral particles wss suggested lirst by H. Alfvén many years ago. On the other hand, the pitch-angle anisotropy is en important ingredient in extending the field-alignad scala length of the double layer. Further, enomalous resisivity may provide additional potential drop in the double layer.

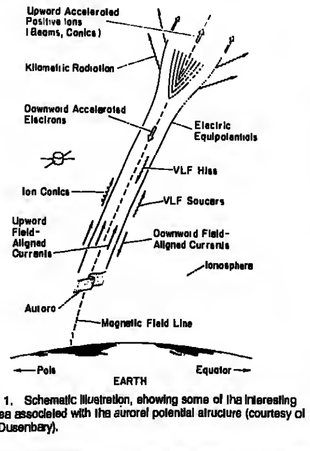


Fig. 1. Schematic illustretion, showing some of the interesting leatures associated with the auroral potential atructure (courtesy of P. B. Dusenbery).

There are a number of fascinating phenomena associated with the auroral potential structura. They are well summarized by Figure 1. These phenomena serve in diagnosing plasma processes that are taking place in the auroral potential structure. For example, during the conference, experimenters and theorists came close to the agreement that the auroral kilometric radiation (AKR) is generated by gyration of electrons trapped in the euroral potential structure. Therefore, the spectral characteristics of the AKR provide important intormetion on the trapped electrons, which are important lor maintaining the double layer potential. It should elso be mentioned that the spectre of auroral electrons are not necesserily in lull agreement with what the potential structure predicts.

It was fortunate that several plasma physicists participated in the discussion of plasma processes associated with the formation of the auroral potential structure from a variety of viewpoints, including computer plasma simulation studies and laboratory experiments. In the history of magnetospheric physics, it mey be thet the euroral potentiel structure is the first subject so comprehensively studied by workers of diverse expertise. Many participants recognized the usefulness of computer simulation studies of spece plasmes.

One of the most important future problems will be to understand the formation of the euroral potential structure as an integrel part of the magnetosphere-ionosphere system, rather than es e plasme region isolated from the reet.

S.-I. Akasofu
Geophysical Institute
University of Alaska

Classified

Structural Geologist or Geophysicist/Washington University. The Department of Earth and Planetary Sciences has available a tenure track or tenured position beginning in the fall of 1982 for a structural geologist or geophysicist. Preference will go to candidates with research interests in field studies or measurements pertaining to the formation and evolution of continental crust. Interests of the candidate should complement those of present faculty in geochemistry, geophysics, and economic geology of Precambrian regions.

The successful candidate must have the following attributes: demonstrated creativity and promise of excellence in research and teaching; intent to develop a vigorous graduate research program; desire to teach courses in field of interest and related fields of geoscience at undergraduate and graduate levels.

Send resume, statement of future research interests, and names of at least three references to Larry Haskin, Chairman, Department of Earth and Planetary Sciences, Washington University, St. Louis, MO 63130. Applications received through February 15, 1982.

Washington University is an equal opportunity/affirmative action employer.

Metamorphic Geologist. The Department of Earth Sciences of Montana State University anticipates a new position in geology and invites applications for a tenure track position at the assistant professor level beginning either June or September, 1982. We seek a field-oriented metamorphic geologist. A background in economic geology or tectonics is desirable. Candidates must be interested in teaching introductory geology and undergraduate mineralogy-petrology courses, and will be expected to participate in summer field instruction. Completion of Ph.D. prior to appointment is strongly preferred. Our department has 11 faculty and is multidisciplinary. B.S. options in geology, geophysics, geographical planning, geography, and meteorology and an M.S. option in geology are currently offered.

Send resume, transcripts, and three letters of recommendation by February 10, 1982 to: Dr. Robert A. Chadwick, Department of Earth Sciences, Montana State University, Bozeman, MT 59717. Montana State University is an affirmative action/equal opportunity employer.

Physical Oceanographer. The School of Oceanography, Oregon State University, is soliciting applications for an assistant or associate professor, depending on experience. Applicants may be observationalists or theoreticians, but must have a Ph.D. in the physical sciences and have demonstrated ability to conduct independent high-quality research and obtain research funding. Duties include teaching and supervision of graduate students. Interested candidates should submit a resume and names of three references by 1 January 1982 to G. Ross Heath, Dean, School of Oceanography, Oregon State University, Corvallis, Oregon 97331.

Affirmative Action Equal Opportunity Employer

Planetary Scientist/Washington University. The Department of Earth and Planetary Sciences has available a tenure track or tenured position beginning in the fall of 1982 for a geoscientist with research interests in such areas as planetary geophysics, planetary materials, or planetary atmospheres. Preference will be given to research areas that complement the current departmental program.

The successful candidate must have the following attributes: demonstrated creativity and promise of excellence in research and teaching; intent to develop a vigorous graduate research program; desire to teach courses in field of interest and related fields of geoscience at undergraduate and graduate levels.

Send resume, statement of future research interests, and names of at least three references to Larry Haskin, Chairman, Department of Earth and Planetary Sciences, Washington University, St. Louis, MO 63130. Applications received through February 15, 1982.

Washington University is an equal opportunity/affirmative action employer.

Assistant Professor: Princeton University. We seek a geologist trained in Sedimentology and/or Paleontology with research interests in Phanerozoic or Precambrian sedimentary geology and history. Appointment is to be effective September 1982 or later depending on availability of candidate.

Applicants should send resumes to: Sheldon Judson, Chairman, Department of Geological and Geophysical Sciences, Princeton University, Princeton, New Jersey 08544.

For Further Information Robert Hargraves, Chairman, Search Committee, Department of Geological and Geophysical Sciences, Princeton University, Princeton, New Jersey 08544.

Princeton University is an equal opportunity affirmative action employer.

THE OHIO STATE UNIVERSITY

The Department of Geology and Mineralogy invites applications for tenure track positions in

HYDROGEOLOGY
AQUEOUS OR ORGANIC GEOCHEMISTRY
GEOPHYSICS OR SEISMOLOGY
SEDIMENTOLOGY OR SEDIMENTARY PETROLOGY

Ph.D. required. Successful applicants will be required to teach graduate and under graduate courses and conduct research. Positions open Fall of 1982, possibly sooner. Rank and salary dependent on qualifications. Send resume, with statement of research record and interests and arrange for at least three letters of references to be sent to.

Peter-Noel Webb, Chairman
Department of Geology and Mineralogy
107 Mendenhall Laboratory
125 South Oval Mall
Columbus, Ohio 43210.

by or before February 1, 1982. Further information on these positions may be obtained by calling (614) 422-2721.

An equal opportunity/affirmative action employer.

Virginia Polytechnic Institute and State University: Senior Research Associate. Interesting and abundant research and publishing opportunities, including new University-owned MDS-10 VICINOSIS system, VAX 11/780 computer. Must have experience in theory and application of reflection seismology, and be interested in the application of reflection seismology to the solution of geologic problems.

Send resumes to: Dr. D. R. Wones, Department of Geological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0798.

The University is an equal opportunity/affirmative action employer.

Faculty Positions: Earth Sciences. SUNY Stony Brook is seeking candidates for two tenure track appointments and one or more visiting professorships for the academic year 1981–82. Rank and salary are dependent on experience and qualifications. Areas of specialization for the tenure track positions include structural geology, tectonophysics, geophysics, mineralogy, petrology, geochemistry, and mineral resources. Duties include teaching graduate and undergraduate courses and conducting original research. The areas of specialization for the visiting professorships are: mineralogy, crystallography, or mineral physics. Send resumes and names of three references to: Professor Gilbert N. Hanson, Department of Earth and Space Sciences, SUNY Stony Brook, Stony Brook, NY 11794.

SUNY Stony Brook is an equal opportunity/affirmative action employer. AK#213.

Structural Geologist/University of Wyoming. The University of Wyoming, Department of Geology and Geophysics seeks applicants for a tenure track appointment in structural geology expected to be available beginning fall semester 1982 or earlier. Duties will include teaching of undergraduate and graduate courses in structural geology, supervising MS and PhD theses, and research in structural geology. Appointment at assistant professor level is preferred, but applicants requesting appointment at higher rank will be considered. Salary open. Applicants must have PhD degree and be versed in quantitative theory as well as field applications of modern structural geology and regional tectonics.

Applicants should provide, by January 1, 1982, a resume, three letters of reference, and a letter of application including a statement of current research interests and courses which the applicant feels qualified to teach. Applications should be sent to:

Dr. Robert S. Houston Head
Department of Geology and Geophysics
University of Wyoming
Laramie, Wyoming 82071-3006.

The University of Wyoming is an equal opportunity affirmative action employer.

Research Associate Position/University of Arizona. The Lunar and Planetary Laboratory anticipates that a postdoctoral position will become available in January 1982. This is a one year, non-renewable position. The position will involve laboratory studies of the infrared spectral reflectances of meteorites, terrestrial silicates and ices. These data will be used for interpretation of high-resolution spectra of asteroids and other planetary satellites. Applicant should have experience with IR spectrometers or the telescope and in the laboratory.

Vita, bibliography, and three letters of reference should be sent by December 31, 1981 to:

Dr. Larry A. Lebofsky
Lunar and Planetary Laboratory
University of Arizona
Tucson, AZ 85721

Equal opportunity affirmative action Title IX Section 504 employer.

University of Hawaii Faculty Positions. The Department of Geology and Geophysics and the Hawaii Institute of Geophysics of the University of Hawaii are seeking applicants for two tenure track positions becoming available January 1, 1982. Applicants should have specialization in (1) *marine geophysics* with emphasis in one or more of the fields: marine seismology, magnetics and gravity; or (2) *marine geology sedimentology*. One of these positions will be filled at a rank of full professor, the other at assistant or associate level.

Applicants should have demonstrated ability to conduct and promote marine research commensurate with the level of the application. Ability to teach at all levels is expected. The positions will be joint ones on an 11-month basis with the Department and the Institute and will involve both teaching and research responsibilities. Apply with resume, expected level of appointment and the names of 3 referees to Chairman, Personnel Committee, Department of Geology and Geophysics, University of Hawaii, Honolulu, Hawaii 96822.

Closing date for applications is January 1, 1982. The University of Hawaii is an affirmative-action/equal opportunity employer.

SENIOR GEOPHYSICIST

A leader in the field of exploration geophysics for both resource and engineering applications located in New England is expanding its staff and has immediate openings for highly qualified geophysicists to work on both national and overseas projects.

Background must include Ph.D. or Masters and 5 years + experience in industry. Primary area of expertise should be interpretation of seismic data, a familiarity with potential field studies is also highly desirable. Job responsibilities will include: design and management of geophysical data acquisition programs for engineering and exploration programs throughout the world; analysis and interpretation of numerous types of geophysical data and development of reports. Salary is negotiable.

If you are interested in joining a growing and dynamic organization that for over twenty-five years has provided industry and government with state-of-the-art geophysical services, then these are excellent career possibilities for you. In addition to positions they also are stimulating and rewarding professional challenges which offer the opportunity for management responsibility. Located in an attractive New England setting and provides excellent benefits and salary opportunities. If you would like to be considered for one of these positions, please forward your resume and salary history to:

Mr. John Doherty
Post Office Box 550
Lyons Street
Westboro, MA 01532.

Engineering Geologist/Geophysicist. The Department of Geological Sciences, University of Saskatchewan, has a vacant tenurable position in engineering geology/geophysics. Applicants should be qualified to teach undergraduate and graduate courses and to conduct research in engineering geology. A background in structural geology may be appropriate. Well-equipped facilities are available for research in rock mechanics, fluid flow through porous media, acoustic, and electrical properties of rocks, and permafrost. Good opportunities exist for joint research with qualifications and experience. Send applications, detailed personal resume including the names of at least three referees, and other supporting data to: Dr. W.O.E. Caldwell, Head, Department of Geological Sciences, University of Saskatchewan, Saskatoon, Saskatchewan, S7N 0W0.

Please note: until November 15, 1981 consideration will be given only to applicants who are Canadians or landed immigrants, after that date all applications will be considered.

Petrologist-Economic Mineralogist/University of Oklahoma. Applications are invited for a tenure-track position, effective September 1, 1982 at the assistant professor level, in petrology and economic mineralogy. The successful applicant is expected to teach graduate courses in his/her specialty, to help teach undergraduate courses in mineralogy-optics-petrography, and to pursue an active research program. Consulting and interacting with mining companies are encouraged.

The University of Oklahoma has made a major commitment to diversify the program in the School of Geology & Geophysics. As a result five tenure-track positions are open for the fall of 1982. Six new faculty were added to the School in the fall of 1981 (bringing the total full-time faculty to 15), and an additional six positions will be available during 1983–1985. A new building that will house the School is in the design stage, and the successful applicant will participate in equipping it.

The Ph.D. degree is required for this position. Preference will be given to petrologists with a strong chemistry background and with a demonstrated interest in the economic geology of metallic and non-metallic mineral deposits. Qualified applicants should arrange to send transcripts of all college and university work, resume, statement of research interests, and three letters of reference to: Dr. Maryellen Cameron, School of Geology and Geophysics, University of Oklahoma, Norman, Oklahoma, 73019. Deadline for applications is December 31, 1981. Faculty members from the School will be interviewing at the November O.S.A. meeting in Cincinnati, Ohio, and at the December A.G.U. meeting in San Francisco, California.

The University of Oklahoma does not discriminate on the basis of race, or sex, and is an equal opportunity employer.

Faculty Positions. *Two Faculty Positions in Geology.* Tenure-track positions in geology, assistant professorships, Ph.D. preferred or equivalent experience. Fall 1982.

Petrologist-Mineralogist. Candidate must be able to teach introductory geology, mineralogy, petrology, geochemistry, and optical mineralogy/petrography.

Invertebrate Paleontologist-Soft-Rock Geologist. Candidate must be able to teach courses in invertebrate paleontology, micropaleontology, sedimentation, and historical geology. Additional expertise in recent marine environments highly desirable.

Applicants are expected to do research in their areas of expertise, and to lead students' field trips. Strong teaching and research commitments expected. Submit applications with resume and copies of transcripts, and have three letters of recommendations sent to the Chairperson, Department of Earth & Space Sciences, Indiana University-Purdue University at Fort Wayne, Fort Wayne, Indiana 46805.

Indiana University-Purdue University is an equal opportunity/affirmative action employer.

Petrology/Geochemistry: Florida International University. Applications are invited for one tenure track position (assistant professor) available from August 1982. The successful candidate will be expected to teach at the undergraduate level and pursue a vigorous research program. The applicant should have a background in petrology and geochemistry. Highly qualified candidates in the areas of geophysics or hydrogeology may also be considered. Applicants should have a Ph.D. degree. Closing date March 15, 1982. Applications including a curriculum vitae, research interests, and three letters of reference should be sent to:

Dr. Leonard Kelter, Chairman, Department of Physical Sciences, Florida International University, Tamiami Trail, Miami, Florida 33199.

FIU is a member of the State University System of Florida and is an equal opportunity/affirmative action employer.

Physical Oceanographer. Royal Roads Military College expects to have a tenure track vacancy in Department of Physics effective 1 July 1982. Candidates should hold doctorate or near doctorate in physical oceanography preferably with experience in digital hardware and microcomputer applications. Appointment expected to be made at assistant professor level but salary and rank dependent on qualifications and experience. Relocation expenses can be provided. Duties include undergraduate teaching in physics and physical oceanography, and research in marine science. Applications should include complete dossier and names of three references and be sent to: Dr. E.S. Graham, Physical, Royal Roads Military College, FMO Victoria, B.C. V0S 1B0.

This competition is open to both men and women. Knowledge of English only is required. Only Canadian citizens or Landed Immigrants need apply.

Route information relative à ce concours est disponible en français et peut être obtenue en écrivant à Dr. Graham.

Iowa State University of Science and Technology/Department of Earth Science.

Applications are invited for two tenure track faculty positions. The rank for each is at the assistant or associate professor level, dependent upon qualifications. The successful applicants will be expected to develop strong research and graduate student programs. Teaching duties will include undergraduate and graduate courses in the areas of expertise.

Mineral Resources/Economic Geology: One position is in mineral resources/economic geology. An applied field orientation is preferred. Iowa State has established a Mining and Mineral Resources Research Institute and an interdepartmental minor in Mineral Resources in order to support and develop research and education in this area. In addition to the appointment in the Department of Earth Sciences there will be full opportunities to interact with these programs.

Geomorphology: The second position is in the general field of geomorphology. Additional expertise in an area related to geomorphology, such as groundwater, engineering geology or remote sensing is also desired. A person with an applied field orientation is being sought.

Each appointment will be on an academic year basis. Opportunities are available for summer teaching appointments. Salaries will be commensurate with qualifications. Application deadlines for both positions are February 15, 1982; later applications will be accepted if a position is not filled. Positions are both currently available and are expected to be filled no later than fall, 1982. For application information please write to:

Bert E. Nordlie
Department of Earth Sciences
263 Science I
Iowa State University
Ames, Iowa 50011

Iowa State University is an equal opportunity/affirmative action employer.

Seismologist/University of Utah. Search extended: the University of Utah is expanding its geophysics program in the Department of Geology and Geophysics by adding a tenure track faculty member in seismology at the assistant to associate professor level. Applicants with backgrounds and specialties in seismic reflection, seismic imaging, and theoretical seismology will be given preference. The individual will be expected to teach undergraduate and graduate courses, and to pursue an active research program with graduate students. The department has modern teaching and research programs in geology and geophysics, and has close associations with the numerical analysis and data processing groups in computer science, electrical engineering and mathematics. The geophysics component of the department has strong research and teaching programs in seismology, electrical and electromagnetic methods, thermal properties of the earth, and potential fields. Current research in seismology includes: seismological and earthquake research utilizing a new POP 11/70 computer with plotter and laminate; monitoring of the intermountain seismic belt by a 55 station telemetered network utilizing a new on-line POP 11/34 computer; major experiments in seismic refraction profiling, investigations of seismic propagation from synthetic seismograms, application of inverse theory to seismology, seismic properties of volcanic systems and allied research in tectonophysics. The closing date for applications is December 31, 1981. A Ph.D. is required for this position. Applicants should submit a vita, transcripts, a letter describing his/her research and teaching goals, and names of five persons for reference to William P. Nash, Chairman, Department of Geology and Geophysics, University of Utah, Salt Lake City, Utah 84112.

University of Utah is an equal opportunity/affirmative action employer.

Geophysical Fluid Dynamicist/Physical Oceanographer. Applications are solicited for a junior faculty position in ocean physics or dynamics to begin in the academic year 1982–83. Areas of interest to the Department include analytical, numerical and laboratory modeling of physical processes and phenomena in the sea.

Yale University is an equal opportunity/affirmative action employer and encourages women and members of minority groups to compete for this position.

Curriculum vitae, publications, and the names of three or more referees should be sent by 31 December 1981 to: Robert S. Cordon, Chairman, Department of Oceology and Geophysics, P.O. Box 6666, New Haven, CT 06511.

Princeton University/Water Resources Program, Department of Civil Engineering. Department of Civil Engineering invites applications for a tenure track, three-year appointment at the assistant professor rank beginning on or before September 1982. Responsibilities include graduate and undergraduate teaching in hydrology and water resources, and participation in research into either hydrological processes associated with infiltration and unsaturated flow or chemical processes and transport in the unsaturated zone. Candidates must have Ph.D. degree with demonstrated teaching ability and scholarship.

Submit resume and references to:

Eric F. Wood, Director
Water Resources Program
Department of Civil Engineering
Princeton University
Princeton, NJ 08544.

Princeton University is an affirmative action/equal opportunity employer.

Faculty Position: Department of Geology/The University of Alberta. The Geology Department has one permanent faculty position available (subject to funding) July 1, 1982. We invite applications from qualified individuals for appointment at the assistant or associate professor level in any of these areas: geomorphology, mathematical geology, engineering geology, process sedimentology and structural geology.

Preference will be given to those applicants who demonstrate an ability to pursue a vigorous research program applying modern concepts and techniques in solving geological problems. The candidate is expected to teach an undergraduate course in quantitative geomorphology, course(s) in his or her specialty, including if qualified, geostatistics. The position also involves supervising Masters and Ph.D. students. A Ph.D. is required and salary is commensurate with education and experience. Canadian citizens and permanent residents will be given preference.

Interested applicants should submit a resumé, publications and names and addresses of three (3) referees to Dr. N.W. Rutter, Chairman, Department of Geology, University of Alberta, Edmonton, Alberta, Canada T6G 2E3. Closing date for applications is February 15, 1982.

The University of Alberta is an equal opportunity employer.

University of Utah Faculty Positions. The Department of Geology and Geophysics invites applications for four tenure track positions at the assistant to associate professor level.

1) *Economic Geology:* The specific area of expertise is open, however, preference will be given to candidates whose research interests are in geological, geochemical, or petrological characteristics of metallic mineral deposits.
2) *Sedimentary geology:* Applicants should have research interests in modern or ancient sedimentary basins.
3) *Seismology:* Applicants with backgrounds and specialties in seismic reflection, seismic imaging or theoretical seismology will be given preference.
4) *Potential fields:* Geophysicist with specialty in potential theory including gravity and magnetics. (The closing date for this position is January 31, 1982).

A Ph.D. or equivalent is required. The vacancies are to be filled by September 1982; the closing date for applications for positions 1–3 is December 31, 1981. Applicants should submit a vita, transcripts, a letter describing his/her research goals, and names of five persons for reference to William P. Nash, Chairman, Department of Geology and Geophysics, University of Utah, Salt Lake City, Utah 84112.

The University of Utah is an equal opportunity/affirmative action employer.

Positions in Oceanography/VIMS. The Virginia Institute of Marine Science (VIMS)/School of Marine Science invites applications for two state funded, oceanography research and teaching positions at the levels of Senior Marine Scientist. VIMS is a broad-based marine science establishment with a mission to provide sound and timely advice to executive agencies and the legislature and to conduct innovative research programs. The School of Marine Science offers M.A. and Ph.D. programs with a faculty of 66 and 139 graduate students.

HEAD, DEPARTMENT OF OEOLOGICAL OCEANOOGRAPHY (#113)

Applicants are sought with research interests in estuarine sedimentary geochemistry, dynamics of cohesive sediment transport, or estuarine and coastal morphodynamics. For further information contact Dr. Robert Byrne (VIMS), 804/642-2111 (Ext. 173).

ESTUARINE AND COASTAL HYDROOYNAMICS (Position #204)

A physical oceanographer with a strong interest in interdisciplinary approaches to complex estuarine and continental shelf problems is desired. For further information contact Dr. Bruce Nelson (VIMS), 804/642-6131 (Ext 244).

Candidates for both positions should have established research credentials and be dedicated to furthering the research and educational programs of the Institute. Demonstrated ability to generate extramural support is expected. Salary range is $24,872 to $34,107 and faculty rank is commensurate with qualifications.

Applicants should send a comprehensive curriculum vita, reprints, and at least three letters of recommendation by February 1, 1982, stating specific position of interest, to: Employment Manager, Personnel Office, College of Wm & Mary, Williamsburg, VA 23185.

An equal opportunity/affirmative action employer.

University of North Dakota. Applications are invited for two tenure-track appointments in the Department of Geology, beginning January 1982:

(1) petroleum geology or related fields
(2) one of the following areas
low-temperature geochemistry
carbonate petrology
economic geology

The first position will include teaching 1 or 2 courses per year in petroleum geology. Both positions require teaching undergraduate and graduate courses in the area(s) of expertise, directing graduate student research at the MS and PhD levels, and developing an active research program.

The Department has nine full-time faculty, two adjunct faculty, about 150 undergraduates and 60 graduate students. Association with the North Dakota Geological Survey includes access to complete subsurface records, cores and samples for 9,000 wells in the Williston Basin. Proximity to the Williston Basin and Canadian Shield provides abundant opportunity for research in sedimentary, igneous, and metamorphic petrology, and economic geology. Excellent physical facilities, the state core and sample library, and excellent photo, map, and book collections are available.

The Ph.D. is required, salary and rank are open and competitive. Applications will be accepted until suitable candidates are found. Applicants should submit complete resumes, including education, previous experience, teaching and research interests, and at least three letters of reference to:

Dr. Richard D. LaFever
Chairman, Search Committee
Department of Geology
University of North Dakota
Grand Forks, ND 58202

STUDENT OPPORTUNITIES

Graduate Teaching & Research Assistantships/University of Houston. Graduate teaching & research assistantships available to qualified persons interested in Space Physics at the University of Houston. Our experimental program features rocket & balloon-borne studies of the ionosphere & magnetosphere-ionosphere coupling. Emphasis has been on active experiments, most recent being a rocket-balloon campaign at Siple station, Antarctica in December 1980. Future work includes a study of pulsating aurora & participation in Watershed II, an auroral quenching experiment. The theoretical program is on plasma waves in the solar wind & modeling of phenomena related to current experiments. Assistantships for first year students begin at $600 mo along with out of state tuition waivers. Graduate Chairman, Physics Dept., University of Houston Central Campus, Houston, TX 77004. EOE

Graduate Research Assistantships in Physical Oceanography. Opportunities for graduate study with research assistantship available for students interested in M.S. or Ph.D programs. A summer program with stipend is open to college juniors. Write: Douglas Caldwell, School of Oceanography, Oregon State University, Corvallis, OR 97331

Graduate Assistantships/Fellowships in Applied Paleomagnetic Research. Opportunities for study, with research assistantships, available for students interested in M.Sc. or Ph.D programs at the Colorado School of Mines. Research topics center around applied paleomagnetic investigations in economic geology, structural geology and stratigraphy/diagenesis and include such areas as the Stillwater Complex, western Colorado volcano-plutonic association (core complexes) Basin and Range, central Colorado and the Powder River Basin. Students with undergraduate majors in geology, geophysics and physics are encouraged to apply. Detailed information can be obtained from.

John Oolfsman
Department of Geology
Colorado School of Mines
Colden, Colorado 80401
(303) 279-0300 Ext 2803

SERVICES, SUPPLIES, COURSES, AND ANNOUNCEMENTS

"Optical Properties of Clouds," a Workshop Report, edited by Peter V. Hobbs and Adarsh Deepak. This 20 page volume contains the report and recommendations of the Workshop "Clouds: Their Formation, Optical Properties, and Effects," Williamsburg, Virginia, May 14 15, 1980, sponsored by Army Atmospheric Sciences Laboratory and Army Research Office. Copies available from Circulation Dept., Spectrum Press, P.O. Box 730, Hampton, Virginia 23666 for $350 each (plus 4% sales tax—Virginia residents only), overseas postage and handling $1.00 surface, $3.00 airmail.

COAL DEPOSITS. If you are financing, planning, designing, exploring, drilling, or digging in connection with any form of energy, you need this complete, up-to-date book about the world's coal deposits. Included production and reserves for mines. Hardcover. 6 × 9 inches, 590 pages. Table of contents, drawings, index, references. 1980. $156. Tetsch Associates, 120 Thunder Road, Sudbury, MA 01776.

AGU

Sonnerup

B. U. Ö. Sonnerup—New JGR-Blue Editor

"JGR is the foremost place to publish research in space physics. You really can't be in this field without having the journal right at your elbow," said Bengt U. Ö. Sonnerup, the new editor of the space physics section of the *Journal of Geophysical Research*. He will formally begin his 4-year term on January 1, succeeding George Siscoe. Sonnerup has been receiving articles for the journal since October 1.

Sonnerup, whose research specialty is magnetopause dynamics, came to the United States from Sweden in 1958 and became involved with magnetospheric science when the field was first blooming.

"What brought me here, I think it's fair to say, was the desire to have a little bit of adventure," Sonnerup said. He had been working in industry in his native country before he was accepted as a graduate student at Cornell, where he earned his master's and doctoral degrees in aerospace engineering. "My original intention was just to stay for a year. However, I enjoyed being a graduate student. In particular," he said, "I got into contact with an exciting new field: magnetohydrodynamics."

Sonnerup remained at Cornell as a postdoctoral fellow, working with Thomas Gold. "It was after I spent a year with him that I decided I didn't want to go back into industry." He did, however, return to Sweden for 2 years, where he worked at the Royal Institute of Technology's Department of Plasma Physics with Hannes Alfvén. "I found pretty quickly, though, that the opportunities for doing research and teaching are greater in the U.S. than in Sweden," he said. "It is true, of course, that in terms of space research, all of the action was in the U.S. at that time." He returned to the U.S. in 1964.

Now, as the Sydney E. Jenkins Professor of Engineering at Dartmouth College, Sonnerup, a theoretician, researches the structure and dynamics of the magnetopause (the boundary between the earth's magnetic field and the ionized gas streaming out from the sun) and of the adjoining plasma boundary layer. In addition to teaching and doing other research on the magnetosphere, he studies the energy-release mechanism in solar flares and the energization of charged particles at shock waves.

His experience with JGR-Blue comes not only from the numerous articles he has published in the journal but also from his stint as associate editor from 1972 to 1974. Sonnerup hopes to make a smooth transition from the former editor to himself. In fact, Sonnerup met with Siscoe in September to review the editorial process.

"I feel that the past editors have done an excellent job," he emphasized. "I intend to maintain the very high quality of the journal." Sonnerup said that once he has settled in, he will write an editorial in the journal to explain his editorial policy and what role he feels JGR does and should play in the space science community. Briefly, he commented, JGR should be an integral part of the ongoing scientific process. As such, published articles should serve not only to document completed research, but also to advance new explanations and hypotheses. "The journal, at least in my experience, is quite willing to accept those hypotheses as long as they are clearly stated and appeal to some kind of a sound observational or theoretical basis. . . . The publishing of such new ideas is absolutely essential to the scientific process."—*BTR*

AGU Congressional Science Fellowship

The Individual selected will spend a year on the staff of a congressional committee or a House or Senate member, advising on a wide range of scientific issues as they pertain to public policy questions.

Prospective applicants should have a broad background in science, be articulate, literate, flexible, and able to work well with people from diverse professional backgrounds. Prior experience in public policy is not necessary, although such experience and/or a demonstrable interest in applying science to the solution of public problems is desirable.

The fellowship carries with it a stipend of up to $25,000 plus travel allowances.

Interested candidates should submit a letter of intent, a curriculum vitae; and three letters of recommendation to AGU. For further details, write Member Programs Division, Congressional Fellowship Program, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, D.C. 20009.

Deadline: March 31, 1982.

JGR-Red Editor for 1983–1986 Term

Thomas J. Ahrens will complete his term as editor of the *Journal of Geophysical Research*—Red at the end of 1982. A selection committee has been appointed to recommend candidates to the AGU president. Nominations for the editor for the red section of JGR for the term 1983–1986 are now being accepted. Those who are interested in serving as editor, or who wish to suggest candidates, should send recommendations by February 15, 1982, directly to

American Geophysical Union
2000 Florida Avenue, NW.
Washington, D.C. 20009
Attention: JGR Search Committee

Nominations for Medals and Awards

William Bowie Medal. Awarded for outstanding contributions to fundamental geophysics and for unselfish cooperation in research.

Maurice Ewing Medal. Honors an individual who has led the way in understanding the physical, geophysical, and geological processes in the ocean; ocean engineering, technology, and instrumentation; or who has given distinguished service to the marine sciences.

James B. Macelwane Awards. Up to three awards are presented each year for significant contributions to the geophysical sciences by a young scientist of outstanding ability. Recipients must be less than 36 years old.

Robert E. Horton Medal. Awarded for outstanding contributions to the geophysical aspects of hydrology.

Letters of nomination outlining significant contributions and curriculum vitae should be sent directly to the appropriate committee chairman: *Bowie Medal*—George D. Garland, Department of Geophysics, University of Toronto, Toronto 5, Ontario, Canada; *Ewing Medal*—Robert O. Reid, Department of Oceanography, Texas A & M University, College Station, TX 77843; *Macelwane Award*—Manik Talwani, Lamont-Doherty Geological Observatory, Palisades, NY 10964; *Horton Medal*—Peter S. Eagleson, Department of Civil Engineering, Building 48-335, Massachusetts Institute of Technology, Cambridge, MA 03139.

DEADLINE FOR NOMINATIONS IS DECEMBER 15, 1981

Meetings

Penrose Conferences

Threa Penroso Conlerencos wore recently onnounced by the Geological Socleiy of Americe. Conference titlas are 'Tectonic History ol the Ouachlla Orogen,' 'Origin ol Fluids and Metols in Porphyry end Eplthermnl Minoral Doposits,' end 'Models of Diagenesis in Clastic Reservoirs.'

Sleled lor May 23–28, 1982, ot DeGray Stato Park Lodge In Arkedelphle, Ark., 'Tectonic History ol lhe Ouechlle Orogen' will leature discussions on the environmonts ol deposition end tectonic fremework ol Eorly to Middle Peleozoic strata; provenence end lectonic lremework ol the cerbonilerous llysch; lhe Penlon-Broken Bow uplilt es a subduction complex; and the regionel tactonic satting ol the Ouachlle orogen. The conference will includa e lield trip in the Ouachlla Mountains eurrounding DeGray Dam and Leke Ouechlle. An optlonal lield trip will bo conducted Mey 23, before the conlarance begins, to the eastern oulcrops ol the Ouachlla Mountains in Arkansas. Tha Ouachlle orogenic belt extends lrom the southwastern Appalachians to the Merathon region ol Texas and into Mexico.

To eltend, conloct elther ol lhe convonors, Willem A. Thomes or George A. Viele, by Februery 15. Indicate your interest in the conlerenca end in the optional liold trip. Also, dascribe areas of discussion lo which you can contribule. Wrile lo Thomas, Daperlment ol Geology, University of Alabama, University, AL 35486, or lo Viole, Dopartment ol Geology, University ol Missourl, Columbla, MO 65211.

The conforonco 'Origin ol Fluids ond Metnls in Porphyry ond Eplthermal Minorel Doposits' will bo hold August 8–13, 1982, at lho Holldny Inn In Dillun, Colo. Topice lo bo covnrod includo lho onvironment's rolo in lho omplacomont ot plutons in tho uppor crust; thn rolation ol lho molal content and minornl assemblngos ol doposits lo plutons; the doduction ol lho chomical noturo ot intruding magmas lrom tha rosulting plutons; and the conditions undor which a pluton will produco e porphyry-typo doposit, e vein daposit, or both. Two 1-day lield trips will include surlace tours ol tha Ideho Springs-Canlrel City and Jameetown mining districts end an underground tour ol lhe Henderson molybdonlte deposil. Thero will bo optional hnll-day surlace tiald trips to other mining dlstricts in contrnl Colorado.

Applications to attond the conferoncn should bo sent to Jim LoAndorson, Department of Goological Enginoering, Colorado School ol Mines, Golden, CO 80401; deadline is April 20. Persons inlerestad in giving an ural presentation or a poster sassion should submit a title and topic description by Fabruary 28. Convenors are LaAnderson, Steva Ludington, and Art Bookstrom.

'Modols ol Diaganesis in Clastic Reservoirs' is schaduled tentetively lor August 15–20, 1982, in Kailua, Kona, Hawoli, tollowing the Clay Mineral Society Annual Meoling on August 8–14 in Hilo, Hawall. The conlaranca will examine diagenatic models pertaining to reservoir rocks. Emphasis will be on the tamporel end spatlel distribution of eltaration products in ectual reservoirs and on theoratical models ol heet, mass, and fluid llow.

To eltend, contact J. R. Wood, COFRC, P.O. Box 446, Le Hebra, CA 90831; deadlina is April 30. Include a briet dascription ot topics to be contributed end tha reason lor wanting to attend. Convenors ot the conlarence are Wood; Ian Hutchaon, Daperlmant ol Geology, University ol Calgary, Calgary, AB, Canada, T2N 1N4; and J. R. Bolas, Department ol Geology, UCSB, Senta Berbare, CA 93017.

National Water Conference

Representelives from the Acsdemy ol Nsturel Sciences, the Amarican Weter Works Associetion, end the Water Pollution Control Federetion will consider how successful the United Steles hes been in its epproech to weter pollution control end other questions releting to weter quelity end the Cleen Water Act during the Netionel Water Conference to ba hald in Philedelphia, Pe., Jenuery 26–27, 1982.

The purpose ol the conlerence le to compila eclentific intormetion on whet hes been echieved by the Cleen Weter Act. 'This intormetion cen be of use to environmentelly concerned people, industry, end lewmakers during their forthcoming deliberetions on the tuture ol the netion's weter pollution control lews,' according to Ruth Patrick, cheirman of the conlerence plenning committee.

For additionel informalion, contect Jemes Wilson, Secretery, The Netional Weter Conlerence, Academy of Netural Sciences, 19th end the Perkwey, Philedelphie, PA 19103 (telephone: 215-299-1107).

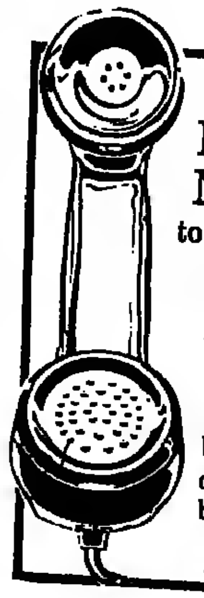
Environmental Engineering Conference

A cell lor pepers hes been issued for the 1982 Netional Conlerence on Envlronmental Engineering, slated for July 14–18, 1982, et the Sheraton-Ritz Holet in Minneapolis, Minn.

Pepers on the following topics ere especially requested: eir quelity, noise pollution, nuclear weste menegement, solid westes, toxic end hazerdous westes, weter pollution, and weter eupply and treatment.

Abetrects ol approximetely 500 words should include the title of peper; title, effiliation, end address of the euthor or authors (indicete which pereon will present the paper); the epproximete dete when the work was or will be completed; end, it epplicable, if the work hes been published or will be published elsewhere by July 1, 1982. Four copies of ebstrects should be eent to Walter K. Johneon, Conference Chairman, Metropoliten Waste Control Commiseion, 350 Metro Squere Building, St. Paul, MN 55101. Abstrects postmarked on or before December 18 will be eccepted for review. Additionel informetion mey be obteined by celling Johnson (telephone: 812-222-8423).

The conference le sponsored by the American Society of Civil Engineers (Environmental Engineering Divielon) in cooperation with the University ot Minneaote Department of Civil and Minerel Engineering, the Minnesota Pollution Control Agency, the Centrel States Water Pollution Control Associetion, and the Minnesota section of ASCE.



GAP

Geodesy and Gravity

[illegible]

Hydrology

[illegible]

Meteorology

[illegible]

attained. No significant trend is found at the 5% significance level.

Models are then refit for the entire sample period and detection thresholds are estimated for time periods after December 1911. The change in O_3 due to trend over the next ten years would need to be as large as 3.5%, 10.4%, and 21.3% in levels 7, 8, and 9, respectively. [illegible]

[illegible]

In the region of the enhanced turbulence. The inner scale of turbulence of the solar wind plasma is of the order of few kilometers at the distances between 6 and 10 R_o and one increases with the increasing radial distances. Typical values of the drift velocity of the irregularities are 30 to 40 km/s at the distances 4 R_o while at the distances greater than 10 R_o the velocity exceeds 400 km/s. (Solar wind, turbulence, corona, radio wave propagation).

Sol. Sci., Paper [illegible]

Particles and Fields—Ionosphare

5575 Aurorae

PROBLEMS WITH THE $N_2^+ + O \rightarrow NO^+ + N$ REACTION IN AURORA

W. Swider (Air Force Geophysics Laboratory, Hanscom AFB, MA 01731), and R. S. Narcisi

An effective rate coefficient for $N_2^+ + O \rightarrow NO^+ + N$ which increases with altitude is deduced from an analysis of the auroral ion composition measured between 120 and 200 km over Poker Flat, Alaska on March [illegible], 1981. This result may be interpreted in terms of a rate coefficient with a positive temperature dependence, roughly [illegible] over a 100-degree temperature range. Other interpretations are discussed, including the possibility that the N_2^+ ions are vibrationally excited.

Geophys. Res. Lett., Paper [illegible]

5510 High-Latitude Ionospheric Currents

RELATIONSHIPS BETWEEN THE BIRKELAND CURRENTS, IONOSPHERIC CURRENTS AND ELECTRIC FIELDS

F. Bleuler (The Ionosphere Research Laboratory, The Pennsylvania State University, University Park, Pennsylvania 16802), C. H. Li and J. S. Nisbet

Calculations are made of the currents and electric fields in the ionosphere using a global model of the electron densities [illegible]

[illegible]

Particles and Fields—Interplanetary Space

[illegible]

Physical Properties of Rocks

[illegible]

Planetology

[illegible]